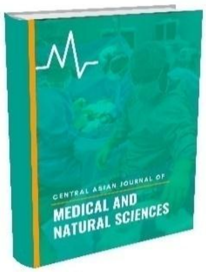
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Modern Views in the Diagnosis of Teething Anomalies

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Annotation: The article states that the anomalies of teething entail a whole series of morphological problems and structural destruction, these include: resorption of the roots of adjacent teeth, the formation of odontogenic tumors, abnormal eruption of adjacent teeth, violation of the capture and biting of food. The totality of everything leads to a number of claims made by patients with teething anomalies from the aesthetic side, among them violations of the smile line, the divergence of the center of the dentition, the anomaly of the position of the teeth, facial asymmetry are particularly noted.

Keywords: Canine retention, dental anomalies, orthopantomography, cone-beam computed tomography.

A retented tooth is the result of a complex coordination of endogenous and exogenous factors. According to the duration of action, factors can be prenatal, natal and postnatal. There are also general and local factors [4,10,12]. Genetic and endocrine factors occupy a special place among common endogenous factors[11,13,15].

The main etiological component of recession and dystrophy of teeth is the reduction of the chewing system occurring during their phylogeny, confirmed by an anthropometric study of human skulls from the Neolithic to the present time. [14,16,18]

Morphological features of the maxillary system, such as size, shape, number of teeth, anteriopposterial location and size of the jaws have been proven that the child will inherit from his parents. The interaction of the genotypes of both parents in the phenotype of the child can lead to the appearance of a disproportion in the size of teeth and jaws. Thus, wide teeth with a narrow jaw lead to a shortage of space in the dentition for individual teeth, thereby causing their retention and dystopia [17,19,21].

The delay in eruption of permanent teeth, as a systemic disorder, can be observed in a number of hereditary syndromes. With hair-tooth-bone syndrome, craniofacial Crouzon dysostosis, Parry-Romberg syndrome, multiple retention or delay of teething is determined in children, which also leads to a change in the oral mucosa. [18,20,22].

The most common among the retention of permanent teeth are: unilateral retention of medial incisors and canines on the upper jaw, second premolars on the lower jaw [3,6]. It should be noted that the permanent canines of the upper jaw (51.1%) are more often exposed to retention among the rest of the teeth among the retarded complete teeth [20].

However, having studied the worldwide data of Russian and foreign authors (J.N. Bakaev, S. Sh. Olimov., 2020), the treatment of patients with this pathology for surgical and orthodontic care in each region is different. So, for example, in the structure of appeals of patients with dental anomalies in Russia, according to studies from 4.0 to 18.0% of patients with retention of the upper permanent canines. And abroad, the prevalence of retention of upper permanent canines, according to recent data, is significantly lower, which ranges from 0.8 to 3.0% [51].

According to other authors (Olimov S. Sh., Bakaev Zh. N., Rahmonova F. Z., 2021), it should be taken into account that retention of the upper permanent canines entails a whole series of morphological problems and structural destruction, these include: resorption of the roots of adjacent teeth, the formation of odontogenic tumors, abnormal eruption of adjacent teeth, violation of grip and biting off food. Which, in turn, leads to a number of claims made by patients who have retained upper permanent canines, from the aesthetic side, among them violations of the smile line, the divergence of the center of the dentition, the anomaly of the position of the teeth, facial asymmetry are particularly noted [16, 42, 43, 44].

It all starts with a prolonged intraosseous movement at this time, the formation and then the eruption of the upper permanent canines occurs. According to the degree of formation of the rudiment of the tooth, the adaptive organization of the dental plate occurs, which is gradually replaced by a lamellar bone with the formation of a bone skeleton, called a bone crypt. The bone crypts of the canines are located near the outer border of the nasal opening anteriorly from the maxillary sinuses, from which they are separated only by a thin bone plate. Calcification of the crowns of the upper canines is completed, and their roots are formed along the border of the bone crypt with the wall of the nasal cavity by the age of 6-7. After the development of one third of the root of the tooth, eruption begins. The canines actually erupt strictly vertically with a slight mesial slope according to the degree of advancement up to one third of the roots of the lateral incisors. Until the occlusal plane is reached by the first, further canine eruption is carried out along the distal surfaces of the lateral incisors [1,2,6,9]. While maintaining the trajectory of eruption of the upper permanent canines described above, characteristic changes are clinically determined. At eight to nine years of age, when palpating the alveolar process of the upper jaw, the roundness is determined in the apex of the milk canine, at 10-11 years of age, the roundness is determined better and is slightly lower. At the age of 11-12, the mobility of milk canines increases [3,5,7,8].

Endocrine factors related to the functions of the endocrine glands, which are of great importance for the functioning of the child, have a significant impact on the formation of the dental system and the development of the oral mucosa. During the period of both prenatal and postnatal improvement of the child, they can influence the origin of dental anomalies. Also according to the judgment of many domestic and foreign authors (Bakaev Zh.N., Olimov S.Sh ., 2020), may lead to an abnormal position and violation of the timing of eruption: hypothyroidism, endemic goiter, idiopathic form of hypoparathyroidism, pseudohypoparathyroidism, cerebral pituitary nanism, Frelich's disease, rickets [19,21,23].

It is also proved that in addition to the above general factors, the unfavorable state of the environment affects the development of the dental apparatus of a child: lack of fluoride in fresh water, insufficient ultraviolet irradiation, excessive radioactive background [24,26,28].

Violation of nasal breathing is attributed to the postnatal common causes of retention of the upper permanent canines. Violation of nasal breathing in the first order, is the cause of physical disorder. The lips are not closed, the mouth is half-open, this is in children breathing through the mouth [25,27,29]. Provokes a narrowing of the upper dentition and in turn leads to a shortage of space for the eruption of all complete teeth is the tongue located at the bottom of the oral cavity, which significantly affects the development of the oral mucosa. There is a narrowing of the nasal passages, dryness of the oral

mucosa in the absence of the child's ability to breathe through the nose, so they say (Bakaev Zh.N., Olimov S.Sh ., 2020) the authors in their studies[30,32,34].

Correlates the location of the crypts of the upper permanent canines and ensures their correct eruption - the width of the pear-shaped opening. The reduced distance between the canines in the case of a narrow pear-shaped opening, respectively, leads to convergence of the incisor roots and their crowding, which subsequently prevents the formation of a channel for the eruption of permanent canines [31,33,35].

According to the research of many foreign and domestic authors, the local causes of tooth retention are diverse. If the maxillary system does not get enough load when feeding a child older than 3 years with soft food, this leads to a lack of space between the temporary front teeth, narrowing of the dentition and, in the future, incorrect eruption [36,38,40].

Any divergence of the teething trajectory from the normal one is called ectopic. This happens often during calcification of the crown as a result of the abnormal position of the tooth rudiment in the bone crypt. However, despite the initial normal position of the rudiment, this usually occurs as a result of injury to the upper incisors, occasionally the trajectory of eruption is deviated [37,39,41].

Retention of permanent canines can be caused by caries, its complications and the associated removal of individual teeth of temporary origin, children often experience loss of a temporary molar, which entails displacement of adjacent standing teeth, abnormal eruption of permanent or mesial eruption of the first permanent molars. With the mesial displacement of the first permanent molars, the dentition in the area of the support zone is shortened and, consequently, there is a lack of space for the canine eruption [36, 40].

A number of studies by other scientists confirm that chronic apical destructive processes of milk teeth, as a result of the displacement of their rudiments by granulation tissue, determine anomalies of position and violations of the timing of eruption of permanent teeth [47, 50, 27].

It is important to take into account that the preservation of the temporary precursor is an important point in the eruption of a permanent tooth, because the bone crypt of the rudiment of a permanent tooth is connected by a guide channel to the temporary tooth [26]. This intraosseous canal contains a fibrous cord with the remains of the epithelium of the dental plate and unites the crypt with the cortical plate and sometimes the wall of the alveoli of the milk tooth. The structural features of the intraosseous canal have a significant impact on the eruption of the tooth, but the diameter of this passage varies depending on the size of the tooth. The diameter of the crown of a permanent canine is much larger than the diameter of its predecessor. Thus, the creation of sufficient space for the eruption of permanent canines depends on the resorption of the bone and the root of the milk tooth [43, 44]. The delay in the loss of the milk canine is a consequence, not the cause of the permanent canine dystopia [46].

Pressure on the rudiments of the corresponding permanent teeth is also the cause of retention by cysts or tumor foci [43]. Odontoma is the most common odontogenic neoplasm, consisting of abnormal or incorrectly differentiated odontogenic tissues [45,46]. Since clinically, an odontoma practically does not differ from an overcomplicated tooth and can also counteract the development and eruption of permanent canines.

Most often, odontogenic cysts are associated with a violation of the eruption of permanent teeth and the upper canines are affected more often than other teeth. The cause of the cyst is sometimes pulpitis of the milk tooth. Provided there is sufficient space in the dental arch, after excision of the neoplasm, the tooth can erupt independently [50, 51].

Shortening and narrowing of the upper dentition, which is also associated with the upper micrognathia, can be one of the causes of canine retraction, which leads to a shortage of space for all complete teeth. [12, 36, 37, 41, 51].

The division of factors leading to retention of permanent canines of the upper jaw into general and local, endogenous and exogenous, according to many authors, is conditional [42, 43, 46].

The etiological factors leading to retention of teeth were systematized into groups among residents of Volgograd. The author identified atypical laying of the rudiments of canines or adjacent teeth, over-complete teeth, odontomas and cysts during eruption, premature mineralization of the tip of the erupting canine as the main reasons for the retention of canines. [38].

The following etiological factors are taken into account: a lack of space in the dentition, an anomaly of the position of an uncut tooth, an anomaly of the size and shape of an uncut tooth, overcomplicated teeth, congenital pathology of the maxillofacial region, based on the results of her own research, another compatriot proposed a clinical and morphological classification of anomalies in the timing of eruption of permanent teeth [15].

It has been established that it is possible to prove the retention of teeth only on the basis of an X-ray examination of the alveolar parts of the jaws [7, 20, 49, 51]. Currently, intraoral X-ray techniques, orthopantomography, telerentgenography, multispiral computed tomography, cone-beam computed tomography are used to diagnose retentive and dystopian teeth [45, 49, 42, 44].

Intraoral radiography, which includes the following types of studies: contact, occlusive and interproximal radiography is performed on dental X-ray diagnostic devices. Intraoral radiography, in the diagnosis of retentive and dystopian teeth, has limited use, since it does not give a holistic view of the state of the dental system. Since with its help it is only possible to identify the presence of the tooth rudiment and its condition, to determine the stage of formation and development of the tooth root, to assess the condition of the periapical tissues, to detect overcomplicated teeth, to determine the prospects of tooth eruption, to identify a pathological focus of a limited nature [17, 22, 25, 47].

Radiovisiography has been developed in dentistry since 1987. By manipulating contrast, brightness, clarity, dimensions by eliminating technical errors, highlighting areas of interest, computer processing of information increases the diagnostic informativeness of the study. A significant reduction in radiation exposure, the possibility of archiving information are also advantages of radiovisiography [44].

For the first time, orthopantomography (OPTG) as a research method was proposed by Blackman in 1939. And only then, in 1956, it was introduced to wide practical use after preparation and mathematical justification by Finnish specialists Soila and Paatero [37]. Being important for the diagnosis of possible pathologies of the hard tissue structures of the teeth, the doctor has the opportunity during OPTG to evaluate both jaws, teeth, temporomandibular joints, paranasal sinuses, which allows you to determine the degree of mineralization of the crowns. and the roots of the teeth, their formation, stage and type of resorption of the roots of temporary teeth.

It is possible to identify the rudiments of non-erupted teeth, determine their position in the jaw and the prospects for eruption, according to the OPTG[79]. In addition, to determine the inclination of erupted and retinated teeth in relation to neighboring ones, it is also possible using orthopantomography[45].

In the works of some researchers, it was proposed to use principles based on the laws of optics: 1) the X-ray shadow of the retented tooth located palatally on the orthopantomogram will always be larger than the symmetrical tooth, 2) the X-ray shadow of the retented tooth located in the thickness of the alveolar process on the orthopantomogram will approach in size to the shadow of the symmetrical tooth, 3) the X-ray shadow of the retented tooth located vestibularly on the orthopantomogram will

always be smaller in size than the symmetrical tooth, 4) the edge sharpness of the tooth more distant from the film plane will always be lower than the shadow of the tooth located closer to the film plane in order to determine the position of the crown of the retented canine of the upper jaw in the vestibular-oral direction[45].

To analyze the popularity of this technique in dental practice, a study was conducted at Manchester Medical University (2009) where, according to a questionnaire survey of dentists, out of 22 dental centers with an X-ray department. It turned out that 73.3% of the surveyed doctors consider orthopantomography to be the most informative method in comparison with intraoral X-ray of teeth and periapical tissues, in endodontic treatment for dentists, in planning procedures for dental surgeons and in the diagnosis and treatment of non-erupted teeth for orthodontists[42]. Therefore, orthopantomography has long been the main method of X-ray examination of patients with uncut teeth. [25, 51].

Despite its great informative value, as with all methods, the orthopantomography method has a number of disadvantages. The spatially selected layer of the image is a plane located strictly vertically, but U-shaped curved horizontally with a thickness of 1-2 cm. It accounts for the frontal department, the largest percentage of distortions, overlays and non-coincidences. The image may overlap on the image of the frontal part of the jaws, the lumen from the uncompressed tongue and the vertebral shadow. Depending on the design of the device and the area of the image, the magnification of objects in the image can be from 1:1.2 to 1:1.75, [51].

In 1922, the Italian anthropologist Paccini proposed Telerentgenography. It was first used in 1931 in orthodontics by Hofrath from Germany and Broadbent from the USA, and it was proposed to do cephalometric analysis by telerentgenogram already in 1934 [10]. This method is widely used in orthodontics to diagnose the consequences of improper development of the jaws (according to Andresen), incorrect position of the teeth, occlusion disorders, jaw shape, joint pathology. Despite some disadvantages, this method is part of a study that can technically classify several variants of dysgnathia into skeletal and dentofacial. In orthodontic clinical practice, telerentgenograms are produced in 2 projections, namely in the straight and lateral. A more accurate and detailed assessment of uncut teeth without orthopantomography is impractical [44, 47].

The location of the permanent canines of the upper jaw can be determined by standard X-ray methods with some image distortion, layering of three-dimensional structures, artifacts, projection errors and sometimes poor image quality[34,35].

The most informative and full-fledged method of radiation diagnostics in dentistry and maxillofacial surgery today is computed tomography [8, 28]. Computed tomography, numerous domestic and foreign authors consider as a priority method of studying patients with dystopia and retention of teeth [11, 29, 38].

In 1974, a CT scanner was tested for the first time. For this invention, its creators subsequently received the Nobel Prize, engineers Cormack and Housefield. Until now, computed tomography, as a method of examining patients with dental anomalies, has been extremely rarely used in dentistry, despite the widest diagnostic possibilities. This is primarily due to the high radiation load from the study and the fact that in most cases the computed tomogram did not have high image quality, which is not necessary for the needs of a dentist[56].

Spiral, sequential, magnetic resonance are the three types of CT scanners that existed until recently: [19, 37, 47]. One of the first comparative radiological studies was conducted at the Vienna Medical University (1995). For the study of 29 volunteers with 36 permanent retentive teeth, a computed tomograph and an orthopantomograph were used. 2 programs were used in the analysis: (conventional and dental). After the study, the authors made the following conclusions: 1) both CT programs are

visually more informative than orthopantomography, 2) the dental CT program is more effective in diagnosing retention, because it more accurately diagnoses resorption at the roots of neighboring teeth [41].

A lower radiation load at CBCT is achieved due to the fact that the value of the anode voltage (volts) and the current strength in the installations are much lower - 70-90 kV and 3-8 mA, and for MSCT these values are 120 - 140 kV and 100 mA, respectively. Depending on the type of tomograph, the radiation load, at one session, ranges from 0.04 to 0.08 mSv[43].

For practically healthy individuals, according to SanPiN 2.6.1.802-99, the effective annual dose should not exceed 1 mSv when performing preventive medical radiological procedures. The method of cone-beam computed tomography, based on these data, can be attributed to low-dose studies [1].

Unlike traditional fluoroscopy, cone-beam computed tomography is the most informative, since it gives images of all anatomical structures in three planes, a section of the object of interest and a series of organ complexes with a thickness from 1 mm to 10 mm [29].

To determine the level of root resorption of lateral incisors in the categories of small and heavy resorption, Alqerban in 2011 determined that CBCT is much better and better than panoramic radiography [47].

The largest promising work was a comparative study in which seven independent doctors received and analyzed data from studies of radiation methods. All patients underwent X-ray images (intraoral and panoramic) and modern-high-tech-digital (cone-beam computed tomography) research methods. According to the data obtained independently from each other, either traditional or high-tech research methods, experts compiled a treatment plan for each patient. Summing up the obtained data of X-ray examinations and only after recalculating the statistical accuracy of the diagnosis and the correctness of the chosen treatment, we concluded that cone-beam computed tomography is more appropriate and preferable to use for the diagnosis and selection of the method and tactics of treatment of teething anomalies [42].

Due to the lack of a clear rationally adjusted systematized methodology that allows conducting and obtaining accurate and exhaustive diagnostic studies, such a diagnostic method has not found wide application, so a number of authors think and assert in their beliefs [43, 44].

An informative and systematized method for the diagnosis of retentive teeth using cone-beam computed tomography (Sirona “GALILEOS”, Morita “3DX”) was proposed by a group of domestic researchers. This technique was aimed at determining and calculating the distances of the oriented area and included: 1) determination of the location of the retented teeth in the anterior and lateral sections of the jaws, as well as the angle of inclination of the longitudinal axes of the retented teeth to the coordinate axes, 2) determination of the distance from the retented tooth to the compact plate of the jaw, 3) determination of bone density in the area of the retented teeth and comparison with the density of bone tissue in the area of the same teeth on the opposite side. The technique inherently offers an algorithm for studying the CBCT data, but does not provide a clear overall overall assessment of the severity of tooth retention, as one of the researchers claims [48].

Another regularity about the "rule of vertical thirds", which refers to the relationship between the distance of the retentive canines of the upper jaw from the occlusal plane and the probability of their removal, was claimed by other researchers and it can be used to predict treatment [37,38].

The angle of inclination, the vertical position relative to the occlusal plane, the anterior-posterior position of the root tip and the degree of overlap of the adjacent incisor are a number of parameters of the CBCT assessment methodology, taking into account the position of the retented canines, which was proposed in 2009 by a group of foreign researchers. Based on the data obtained and the evaluation

of these parameters, the author determines and makes a forecast of the eruption of the upper permanent canines [45].

Until now, there is no universal single agreement in orthodontic practice, according to which criteria would be allocated for determining the possibility of orthodontic treatment of uncut canines, so in 2015, many foreign researchers point to this fact in their publications. Using the CBCT data, the authors identified 10 parameters for determining the difficulty of treatment of retentive canines, established as a result of a literary review, 237 articles devoted to the retention of upper permanent canines. The age of the patient, the position of the retented tooth in three planes, the presence of a transposition of the retented tooth with a lateral incisor or the first premolar, the presence of dilaceration (shadow imposition) of the root of the retented tooth, the presence of resorption of the roots of neighboring teeth - these are the factors that have an undeniable influence on the complexity of the course of orthodontic treatment in patients with retention of the upper permanent canines, so using the data of the CBCT, the authors indicate in conclusion [42].

Based on the variety and diversity of etiological factors leading to delayed eruption or non-eruption of the upper permanent canines, it can be concluded that dynamic and systematic monitoring of the eruption of these teeth in children, which include various radiological methods of examinations starting from the period of early replacement bite.

Thus, in the literature review aimed at studying the diagnosis and diagnosis of retention of the upper permanent canines, it is established that it is not possible without the use of various radiological research methods. The most recent of the currently available is CBCT, which combines, with low radiation exposure to the patient, obtaining a large volume of accurate diagnostic data. Many literary sources describe various methods of evaluating X-ray studies for the purpose of diagnosing and planning treatment of delayed or uncut upper permanent canines, however, there are no works concerning the X-ray evaluation of the dental system of children during early replacement bite in order to prevent the formation of retention of canines. And yet we do not have the right to judge and persuade to use this or another technique, or which technique is better than another for conducting research, because much depends on the economic development and welfare of a particular region. It also depends not a little on the orthodontist, namely in the ability to read the information received by one or another resource. And only a competent Doctor in the hands of even one intraoral or panoramic picture can tell a lot.

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